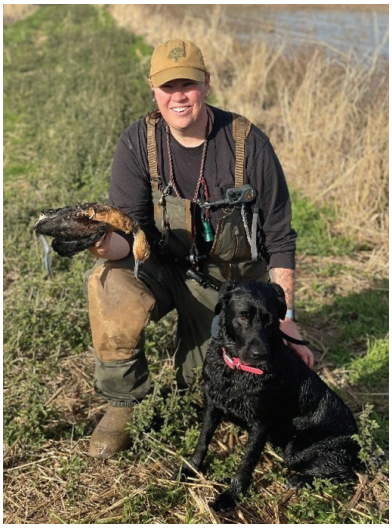
2023-2024

WATERFOWL PROJECT REPORT

SOUTH CAROLINA DEPARTMENT OF NATURAL RESOURCES

25-14529

TABLE OF CONTENTS



STATEWIDE WATERFOWL BIOLOGIST

Molly Kneece has served as Statewide Waterfowl Biologist for South Carolina Department of Natural Resources (SCDNR) since fall of 2021 and has been an employee of the agency in waterfowl management for eight years. She brings 13 years of wetland and waterfowl management experience to SCDNR but her interest in natural resources, land management and wildlife began at an early age on her family's farm in Lexington County.

Kneece's formal waterfowl career began in 2011 in the tidal marshes and coastal impoundments of the ACE (Ashepoo, Edisto, Combahee) Basin of South Carolina. As a field technician for the Nemours Wildlife Foundation (Yemassee, SC), Kneece worked on the first research project to investigate mottled duck habitat selection and nesting ecology in South Carolina (Shipes 2014; Shipes et al. 2015). Looking to further her career and gain valuable waterfowl management experience, she obtained a Master of Science in Waterfowl Ecology and Management (2016) at Mississippi State University. During her studies, Kneece developed and completed a research project investigating survival, breeding and brood-rearing ecology of mottled ducks in the tidal impoundments of coastal South Carolina (Kneece 2016; Kneece et al. 2019). While completing this research in SC, Kneece had the opportunity to work alongside and learn from some of the most tenured and successful waterfowl habitat managers on private, state, and federally owned properties in the ACE Basin. With the experience gained in the field and through her degree studies, Kneece developed a unique skill set--learning the art and science of managing habitat for waterfowl in brackish and moist soil wetlands in coastal South Carolina.

As Statewide Waterfowl Biologist, Kneece's duties are to:

1. Provide technical assistance and habitat management guidance to support SCDNR field staff working on agency waterfowl areas and public waterfowl hunting areas.
2. Implement a waterfowl management area review program that evaluates wetland habitats, management regimes, infrastructure, and waterfowl hunt programs on all SCDNR waterfowl properties.
3. Assist with the implementation and evaluation of the Waterfowl Lottery Hunt Program by seeking ways to increase public hunting opportunities, enhance existing public hunting areas, and establish new waterfowl hunting areas.
4. Represent interests of the state of South Carolina and the agency on the Atlantic Flyway Council Technical Section.
5. Provide leadership and guidance for the annual selection of migratory bird hunting regulations.
6. Develop standard monitoring programs and coordinate research for waterfowl issues of management concern.
7. Provide educational opportunities and technical assistance for state and federal agencies, and public constituent groups.
8. Cultivate relationships with constituent groups through updates and outreach to foster good rapport and support for waterfowl in South Carolina.

STATEWIDE WATERFOWL BIOLOGIST REPORT

In 2023, site visits to SCDNR properties were a high priority. Kneece visited agency-owned waterfowl areas on 44 occasions with Santee Delta, Santee Coastal Reserve, Bear Island, Beaverdam Creek, Clemson Youth Area, and Samworth Wildlife Management Areas (WMAs) being visited most frequently. All site visits provided opportunities for Kneece to engage with project biologists and technicians, and to learn about the unique challenges and needs of each waterfowl area.

Following site visits, Kneece and staff quickly went to work to implement infrastructure plans and expand management potential on three waterfowl areas. Staff at the Clemson Waterfowl Area improved field drainage for planting crops and installed fencing to prevent feral hog damage to crops. On Love Farm WMA, staff secured permits to sub-divide an existing impoundment to improve water level management and increase the total acreage of waterfowl habitat on the property. Once completed this project will increase plant and flood waterfowl habitat on the property by 27%. On Wateree River Heritage Preserve (HP) WMA, in a partnership with Ducks Unlimited, SCDNR has applied for grant funding through the North American Wetlands Conservation Act. If awarded, the grant will allow for the restoration of a 33-acre greentree reservoir and will also enhance approximately 50 additional acres of waterfowl habitat on the property adjacent to the Wateree River.

Through the Waterfowl Management Area Review program, Kneece and field staff engaged with tenured waterfowl and wetland management professionals from across the Southeast to critically evaluate management and infrastructure on two waterfowl areas. An evaluation of Bear Island WMA was completed by the review team of Stephen Rockwood (retired, Florida Fish & Wildlife Conservation Commission; Ducks Unlimited, Texas), David Richard (retired, Louisiana Dept. Wildlife & Fisheries; Stream Property Management, Louisiana), and Bill Mace (retired, SCDNR; Annandale Plantation, Georgetown, South Carolina). An evaluation was also completed at Santee Coastal Reserve with the team of Dr. Todd Merendino (Ducks Unlimited, Southwest Unit, Texas), Lew Crouch (Cheeha-Combahee Plantation, Wiggins, South Carolina), and Michael Prevost (Rochelle Plantation, Georgetown, South Carolina). Collectively, each team contributed more than 220 years of coastal wetland management experience to these reviews. Both properties received accolades for their habitat management, recent infrastructure improvements, and knowledgeable staff. Complete reports for Bear Island and Santee Coastal Reserve can be found at: https://www.dnr.sc.gov/hunting/migratory.html.

Habitat assessments and waterfowl surveys are important tools to evaluate the energetic needs of wintering waterfowl on SCDNR waterfowl areas. Kneece sought to equip biologists and technicians with efficient field methods to assess habitat quality and quantity (i.e. food resources) being produced each year on SCDNR managed waterfowl areas. Beginning with a trial season, biologists and technicians implemented habitat assessment techniques of Martin et al. 2023 and Highway et al. 2024 to estimate waterfowl energy days (WED; A unit that measures how many waterfowl one acre of a given habitat can support for one day) produced in moist soil and planted waterfowl areas.

Wintering waterfowl abundance surveys provide biologists with metrics to determine if the amount of WEDs produced on SCDNR waterfowl areas are sufficient to sustain the numbers of migratory waterfowl using these sites throughout the winter season. Between fall and winter 2023-24, ground counts to estimate weekly waterfowl abundance and a mid-winter aerial waterfowl survey were also implemented on a sub-set of waterfowl areas.

A survey to measure hunter preferences for duck season dates was completed in October 2023. Results from this survey will be used by SCDNR staff to make informed decisions when recommending annual migratory bird hunting season dates to the SCDNR Board. A report of the survey results can be found at: https://www.dnr.sc.gov/hunting/migratory.html.

Assessments were completed to evaluate Category 1 lottery hunt harvest trends for the 2023-2024 season. Harvest estimates and survival rates were analyzed and monitored for wood ducks and mottled ducks banded in South Carolina. In 2023, staff also banded 539 wood ducks, 298 mottled ducks, 17 mallards, 10 American green-winged teal, eight black-bellied whistling ducks, and one northern pintail to contribute to USFWS monitoring and assessment efforts.

Outreach and education opportunities in 2023 included four private lands technical assistance visits, three invited presentations (Ducks Unlimited SC Granders Luncheon, SC Plantation Managers Association, 4-H Wild at Webb Camp), Ducks Unlimited Podcast Episode 533 (South Carolina Ducks, Habitat, Hunting, and Research), three appearances on the SC Wild Radio Show with Maj. Billy Downer, one news interview, and one media publication.

RESEARCH UPDATES

REGIONAL EXAMINATION OF THE CONTRIBUTION OF NEST BOXES TO WOOD DUCK RECRUITMENT IN THE SOUTHEASTERN U.S., 2019-2024

South Carolina Department of Natural Resources has completed a six-year (2019-2024) partnership with the Nemours Wildlife Foundation and the James C. Kennedy Center for Waterfowl & Wetlands Conservation Center (Clemson University) to investigate the contribution of nest boxes to wood duck recruitment in South Carolina and the southeast U.S. Recruitment is an important metric for evaluating the benefit of nest boxes as a tool to increase populations of wood ducks. Our participation in this research project was an integral part of a regional effort of seven states from the Atlantic and Mississippi Flyways including: North Carolina, Maryland, Delaware, Georgia, Florida, Mississippi, and Louisiana.

Study objectives included:

1. Estimating annual duckling production from established nest boxes; estimating annual female recruitment.
2. Determining site characteristics that influence nest box selection, nest success, duckling production, female recruitment, and nest parasitism.
3. Determining if nest box design influences production.
4. Developing management recommendations that enhance the contribution of nest boxes to wood duck populations.

During the 2023 field season in South Carolina, 160 wood duck boxes were monitored on Lake Moultrie and 236 nesting attempts were documented. Across the four years of field data collection, 50% of nests monitored in the study were successfully hatched, 18% were abandoned by the hen, and 28% were depredated.

From 2019-2023, a total of 4,145 wood duck ducklings from boxes on Lake Moultrie have been outfitted with web-tags to aid in recruitment monitoring. Through the 2022-2023 hunting season, hunters have reported harvesting 34 wood ducks having web-tags. Known harvest locations were reported for 22 web-tagged wood ducks in South Carolina, two in Florida, and one each in North Carolina, Louisiana, and Mississippi (Figure 1).

As part of this research effort, Emily Miller completed a Master of Science (MS) thesis with Clemson University in 2022 titled, “Recruitment, Cost Indexes, and Management of Box-Nesting Wood Ducks in South and North Carolina.” The study examined nearly 400 nest boxes and reported a nest success of 54%. Using published recruitment rates and average recruitment rates from Lake Moultrie (SC) boxes, Miller determined the average cost per recruited yearling female wood duck was 1-4 times less than the cost of the box and its management over 20 years, suggesting nest boxes are cost-efficient tools to benefit wood duck population management. Miller observed that rat snakes and woodpeckers were responsible for 40% and 22% of nest depredation events, respectively. Snake-A-Way pellets and Bird-B-Gone plastic hawk decoys were evaluated for their success in deterring snakes and woodpeckers from nest boxes. Snake-A-Way pellets produced no significant difference in snake depredation events, while the Bird-B-Gone hawk decoy did produce

a significant difference in the number of successful boxes. Two additional MS theses (Mississippi State University & University of Delaware) and one Ph.D. dissertation (Louisiana State University) have also been completed as part of the regional study.

In 2024, Nemours Wildlife Foundation completed a comprehensive recruitment rate estimation analysis using the regional data collected from all nest boxes examined during the study. Numerous peer-reviewed publications are expected to be produced from this analysis by researchers from Clemson University, Mississippi State University, University of Delaware, and Louisiana State University. Information from forthcoming peer-reviewed publications will be used to provide natural resources agencies and the public with best practices for site selection and monitoring to maximize wood duck recruitment from nest boxes.

MIGRATION ECOLOGY AND DEMOGRAPHICS OF EASTERN MALLARDS, 2022-2026

South Carolina Department of Natural Resources has partnered with 22 agencies, including state natural resources agencies, the U.S. Fish and Wildlife Service, the Canadian Wildlife Service, Ducks Unlimited, University of Saskatchewan, State University of New York Brockport, and a private landowner group on a study to evaluate the migration ecology and reproductive parameters of eastern mallards in the United States and eastern Canada.

During the mid-1990s, eastern mallard breeding populations peaked at approximately 1.4 million, but breeding populations have experienced a steady decline of approximately 1% annually to a breeding population estimate of 1.05 million in 2019 (USFWS 2019). While the overall declining trend is worrisome, a greater concern is the sub-population of breeding mallards in the northeastern U.S. is declining rapidly (-36% over the last 20 years), while the sub-population in eastern Canada remains relatively stable (-5%).

To manage eastern mallards more effectively, managers need more reliable estimates of productivity, brood survival, and seasonal survival at sub-population scales. Using GPS locations from hen mallards outfitted with transmitters, researchers can monitor the daily survival and behavioral patterns, habitat use, nest locations, nest success, and movements of hens with broods. Using drone technologies, researchers will also evaluate daily survival of broods with hens having GPS transmitters. Using this information, researchers will gain critical knowledge of eastern mallard habitat use and selection. This information will be valuable for property managers looking to improve breeding, staging, and wintering habitat throughout the Atlantic Flyway. A greater understanding of seasonal survival and production will also provide waterfowl biologists with improved metrics to evaluate the performance of harvest strategy models used for recommending hunting season lengths and bag limits in the Atlantic Flyway.

During this study a minimum of 1,200 GPS transmitters will be deployed on female mallards during late winter and early spring in eastern Canada and Atlantic Flyway states. Transmitters are solar battery-powered units and can provide researchers location information for up to two years, given survival of the hen mallards. We intend to deploy 30 GPS transmitters in South Carolina during the study. Thus far, a total of 14 GPS transmitters have been deployed on female mallards in South Carolina in February 2022-2024. Capture and marking with transmitters will continue in February 2025-2026.

Mallard hens marked with GPS transmitters in South Carolina were captured on private land sites in Kershaw, Spartanburg, and Greenwood Counties. February 2022-December 2023 migration movements from marked individuals emphasize the importance of the Great Lakes and Southern Ontario regions for mallards that winter in South Carolina (Figure 2).

While field seasons for this project will continue through February 2026, analysis of data is already underway. Two Masters of Science theses are in progress at the State University of New York Brockport with Dr. Jacob Straub, “Migration Chronology and Winter Habitat Use of Mallards in the Atlantic Flyway” (Daria Sparks) and “Monitoring Mallard Brood Habitat Use and Survival in the Atlantic Flyway” (Abigail Butler). Cassidy Waldrep, a Ph.D. candidate at the University of Saskatchewan, will produce a dissertation titled “Eastern Mallard Migration, Population, and Behavioral Ecology.” These studies will greatly expand our knowledge of Atlantic Flyway mallards to improve habitat management and contribute to revision of hunting season framework (i.e. season length and bag limit) harvest strategy models for mallards.

2023-24 WATERFOWL LOTTERY HUNT PARTICIPATION AND HARVEST RESULTS

Category 1 waterfowl areas are available to hunters only by special permit obtained through the SCDNR Lottery Hunt Program. These areas are managed to attract and hold ducks for the duration of the waterfowl season and disturbance is managed by limiting hunting days. During the 2023-24 waterfowl season, Category 1 Waterfowl Lottery Hunts were administered on eight WMAs: Beaverdam Creek, Bear Island, Broad River, Sandy Beach, Samworth, Santee Coastal Reserve, Santee Delta East, and Wateree River HP. The 2023-24 season was the first since the 2019-20 season that Samworth and Santee Delta East WMAs were included in the lottery hunt program due to the completion of extensive, long-term renovation projects that had been occurring on those properties.

The 2023-24 waterfowl season provided 81 lottery waterfowl hunting opportunities for 1,022 individuals. This season we experienced two notable weather events that produced extreme flooding (see Habitat and Infrastructure Updates). Out of precaution for public safety on these WMAs during these events, seven lottery hunts were cancelled on the following WMAs: Beaverdam Creek (1), Broad River (2), Santee Coastal Reserve on Cedar Island (1), and Santee Delta East (3). These cancellations reduced overall potential participation by 61 hunters. Those affected by cancellations had their preference points restored. At the conclusion of the season, we experienced a 91% participation rate for lottery waterfowl hunts (Table 1).

Since the1998-99 season waterfowl hunters have enjoyed a six duck per day bag limit. The long-term ducks per hunter harvest average with a six-duck bag limit for all Category 1 hunt sites is 3.16 ducks/hunter. The 2023-24 ducks per hunter harvest average of 2.99 on for all Category 1 lottery hunt properties is comparable to the long-term average (Figure 3). The top five species of harvest were green-winged teal (28%), blue-winged teal (17%), gadwall (12%), northern shoveler (10%), and northern pintail (8.5%). Table 2 reports harvest composition and harvest averages by property for the 2023-24 season.

YOUTH WATERFOWL LOTTERY HUNTS

During the 2023-24 waterfowl season, 29 youth waterfowl hunts were conducted through the Lottery Hunt Program and provided opportunities for 132 youth hunters. Bonneau Ferry, Clemson, and Donnelley WMAs provided weekly hunting opportunities throughout the season, whereas Bear Island, Beaverdam Creek, Broad River, Santee Coastal Reserve, Sandy Beach, and Wateree River HP WMAs provided opportunities on the first Federal Youth Waterfowl Hunting Day in February. We observed an 84% participation rate for youth lottery waterfowl hunts.

The 2023-24 ducks per youth hunter harvest average was 2.5, comparable to the 2.8 ducks per youth hunter average in 2022-23. The top five species of harvest on youth hunts were green-winged teal (33%), ring-necked duck (21%), wood duck (15%), merganser (8%), and gadwall (5%). Table 3 reports harvest composition and harvest averages for youth only hunts by property for the 2023-24 season.

MIDWINTER AERIAL SURVEYS FOR WATERFOWL:

HISTORICAL PERSPECTIVES AND A MODERN APPROACH

Beginning annually in 1955, the USFWS and state natural resources agencies partnered to conduct aerial Midwinter Surveys (MWS). These surveys were used to census the abundance of waterfowl in important wintering areas for the purpose of providing long-term data on population trends, distribution, and habitat associations. While the MWS has provided valuable data to support conservation efforts, its methods and usefulness have become highly questioned as new population surveys have been developed and become operational (Eggeman and Johnson 1989, Heusmann 1999). In 2012, a comprehensive review of the MWS was conducted by all four Flyway Councils and the USFWS. The Atlantic Flyway Council and the USFWS concluded that the MWS was of low value to the flyway, and acknowledged it was no longer being used as an instrument for determining and setting waterfowl hunting season regulations. When the USFWS and the Flyway Councils conducted their review, many states had already discontinued their participation in the MWS and while those continuing to survey were doing so with a reduced geographic scope. With the implementation of new and varying sampling designs across the Atlantic Flyway and changes in the geographic scope of the traditional MWS areas, the resulting data was no longer comparable to long-term trend data. Consequently in 2015, the USFWS discontinued its involvement with MWS in the Atlantic Flyway.

In 2016, Clemson University and SCDNR began to investigate a survey methodology to use in place of the traditional MWS that could produce reliable and precise estimates of waterfowl and their distributions (i.e. coefficient of variation [CV] < 20%). From 2017-2019 during fall and winter, Clemson used stratified random sampling aerial strip-transect surveys to evaluate migration chronology and estimate abundance of ducks, waterbirds, and wading birds. Surveys were conducted in 10 geographic areas of the coastal zone and coastal plain. Impoundments, coastal marshes, estuaries, tidal and freshwater rivers, reservoirs, and ponds were included in the survey (Masto et al. 2020).

The final evaluation of the Clemson survey methodology indicated the total area surveyed under the proposed protocol was not large enough to produce statistically precise abundance estimates of waterfowl with a CV of <20%. Researchers proposed two options to increase the precision of abundance estimates in future surveys: 1) Increase the area being surveyed by 2.5 times the current survey effort; or 2) Use the survey areas established in the study and implement a complete survey in small areas or habitats having high densities of waterfowl in place of strip-transects per the methods of Hagy 2020 (Masto et al. 2020).

As evaluations of the Clemson surveys were completed, the USFWS Southeast Region resumed a Modified Mid-Winter Survey (hereafter, MMWS) on select National Wildlife Refuges under newly established methods of Hagy 2020. The MMWS

method uses stratified random sampling procedures also used by Clemson but also integrated complete counts of high-density areas of observation (Hagy 2020). A notable difference between the two procedures, the Clemson survey was flown numerous times per season whereas the MMWS is only flown once per season in early January like the traditional MWS. This approach reduces season-long survey efforts and budgetary restraints while still producing precision estimates of abundance and establishing wintering trends. The MMWS also produces a total wintering abundance estimate for waterfowl by incorporating migration curve data.

After detailed review, the USFWS MMWS satisfied precision estimate requirements and monitoring needs. Adopting MMWS methods would also allow for comparison of abundance and trends among state owned WMAs and NWRs across the Southeast, eliminating one of the primary flaws of the traditional MWS. This gives greater value to the abundance estimates and trends for habitat management, planning, and establishing hunting season regulations in South Carolina.

In Winter 2023-24, SCDNR partnered with the USFWS for an experimental season to implement the MMWS method on the following properties: Bear Island WMA, Samworth WMA, Sandy Beach WMA, Santee Coastal Reserve WMA, Santee Delta WMA, and the Tom Yawkey Wildlife Center (hereafter, Yawkey). Surveys were also conducted on Cape Romain, Hollings-ACE Basin, Santee, and Savannah NWRs. USFWS pilots and biologists conducted the survey using USFWS aircraft equipped for overwater surveys. One SCDNR staff member also participated in the survey to gain aerial survey experience and training.

Surveys were conducted on January 17-18, 2024. An estimated 59,213 waterfowl were counted on SCDNR surveyed properties. Santee Coastal Reserve and Yakwey reported the highest abundances of dabbling and diving ducks which comprised 87% and 13% of the estimate. Table 4 reports the abundance of waterfowl by WMA and guild as estimated during the survey.

South Carolina Department of Natural Resources will continue to partner with the USFWS to implement the MMWS in January 2025.

GROUND COUNT SURVEYS FOR WATERFOWL, 2023-2024

During the 2023-2024 waterfowl season, ground surveys were implemented to document the abundance of ducks using lottery hunt properties throughout the waterfowl hunting season. Surveys were completed weekly, or once every two weeks as part of routine preparations for lottery waterfowl hunts. By integrating the surveys into pre-planned activities such as scouting or monitoring of water levels, staff were able to conduct surveys with no additional disturbance to hunted areas.

Counts were conducted on the following waterfowl areas: Beaverdam Creek, Bonneau Ferry, Broad River, Clemson, Donnelley, Love Farm, Samworth, Sandy Beach, Santee Delta East, and Wateree River HP. Ground surveys were omitted from Bear Island and Santee Coastal Reserve WMAs. Due to the size and distribution of impoundments on these properties, ground counts would create additional disturbance and have high potential for double counting ducks that flush between impoundments along survey routes. Therefore, abundance estimates for Bear Island and Santee Coastal Reserve were obtained through the MWS (see Midwinter Aerial Surveys for Waterfowl).

Ground surveys were initiated during the week of Dec. 12, 2023, and continued through the week of Jan. 28, 2024. Staff were instructed to estimate the number of waterfowl that they could see on each managed wetland and to avoid intentionally flushing any waterfowl for the purpose of obtaining a complete count. Therefore, these counts are considered minimum abundance estimates for each area.

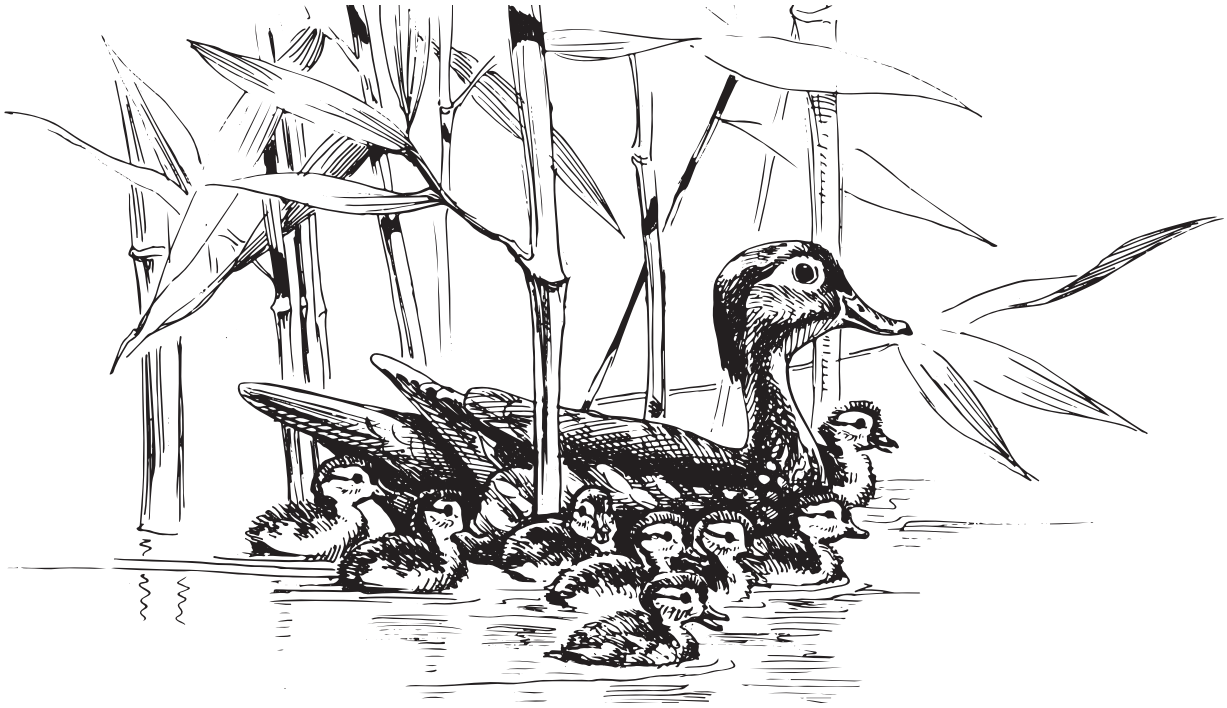
Over the eight-week survey period, 65 ground surveys were completed on 10 waterfowl areas. Significant rainfall events during the first week of January resulted in severe flooding of Clemson, Beaverdam, and Broad River waterfowl areas. River flooding during the second week of January prohibited access to Santee Delta East. In these locations, staff were restricted from safely accessing these areas and surveys were not completed. Wateree River HP WMA and Love Farm WMA were hunted twice, every other week. Therefore, surveys on those properties were only conducted during the weeks they were hunted in effort to minimize unnecessary disturbance to those areas.

Throughout the season, a total of 16,347 ducks were counted on the 10 waterfowl areas included in the survey. Abundances varied greatly by week and property (Figure 4). Donnelley, Santee Delta East, Sandy Beach, and Wateree River HP observed peaks in abundance during second week of the survey, in occurrence with a Nor'easter storm event December 17-23. Inland properties, Beaverdam and Broad River experienced peak abundances following the Nor'easter, Dec. 24-30. Bonneau Ferry and Samworth benefitted from a strong winter cold front and observed peak abundances during week of Jan. 7-13.

These surveys will resume for the 2024-25 waterfowl season.

MIGRATORY WATERFOWL PERMIT BUDGET & EXPENDITURES, FY23 &24

The South Carolina Migratory Waterfowl Permit, commonly referred to as the “SC Duck Stamp” is a $15.50 licensing requirement for resident and non-resident waterfowl hunters in South Carolina. A 10% portion of annual permit revenue is allotted to the Association of Fish and Wildlife Agencies’ Fall Flight Program. This program is administered through Ducks Unlimited Canada where funding is used for the propagation, management, and protection of ducks and geese on breeding ground areas associated with waterfowl that winter in South Carolina. Beginning July 1, 2025, and for succeeding years, 20% of annual SC Duck Stamp permit revenue will be allotted to the Fall Flights Program. The remaining annual revenue generated from the purchase of the duck stamp is allocated to SCDNR specifically for the management of waterfowl habitats and for the development, protection, and propagation of wild waterfowl in South Carolina. Each year, in addition to annual budget requests, staff managing waterfowl properties request additional duck stamp funding for special projects, habitat management, infrastructure improvements, and research on waterfowl areas. Tables 5 and 6 summarize duck stamp funding requests and expenditures for FY23 & 24. Notable expenditures for FY23 and 24 include: Transmitters for the Eastern mallard migration research project (Figure 5); Seed for habitat management that produced excellent stands of corn and millet at Broad River WMA (Figure 6); A storage container for Santee Delta WMA (Figure 7); Multiple drive-on floating docks for boat storage in the impoundments of Cedar and Murphy Island at Santee Coastal Reserve (Figure 8); Annual construction and material costs for the popular State Wood Duck Box Program (Figure 9).



HABITAT ASSESSMENTS

In 2023, staff sought methods to assess habitat quantity and quality on our waterfowl areas to ensure that energetic demands of wintering waterfowl are being met on SCDNR properties. Peer-reviewed habitat surveys were implemented to evaluate the food production of moist soil, corn, and rice being grown for waterfowl on SCDNR waterfowl areas (Martin et al. 2023, Highway et al. 2024). These scientifically peer-reviewed surveys are the best tools of the day to estimate the abundance and quality of food resources being produced for waterfowl as an estimate of waterfowl energy days (i.e. WEDs; A unit that measures how many waterfowl one acre of a given habitat can support for one day). These habitat surveys are also being applied on Southeast Region NWRs as part of the USFWS Waterfowl Monitoring Strategic Plan (Hagy et al. 2021). By using the same methodologies, we can compare habitat productivity to that of similar sites in the southeast region. When we combine these surveys with the abundances estimates from MMWS, we utilize a scientifically reviewed and supported tool to evaluate if SCDNR properties are meeting the energetic demands of waterfowl wintering on our properties.

Fall 2023 was considered a trial year for implementing habitat assessments. The trial year was used to familiarize area biologists and technicians with assessment methodologies and to learn more about the time that will be required to implement the assessment on all moist soil, corn, and rice acreage in the future. Therefore, a sub-set of managed habitats were evaluated on the following SCDNR waterfowl areas: Bear Island, Bonneau Ferry, Broad River, Donnelley, Love Farm, Samworth, Santee Delta East, and Wateree River HP. A total of 396 acres of moist soil, 41 acres of corn, and 6 acres of rice were surveyed across all sites. A total of 2,137,663 WEDs were produced 396 acres of habitat that were assessed. Details by habitat type and site can be found in Table 7.

In 2024, habitat surveys will be implemented on all Category 1 sites growing moist soil, corn, or rice and allow for a complete comparison of energy supply and demand by waterfowl using these areas. Once the habitat assessments are implemented to the full scale of managed wetland acres, abundance estimates from ground and aerial surveys will be integrated to examine if energetic needs of wintering waterfowl are being met on SCDNR waterfowl areas.

Existing surveys for submersed vegetation and agricultural crops such as planted millets, chufa, and sorghum require extensive processing in a laboratory setting to estimate WEDs. Staff are completing a literature review to determine waterfowl energetic quality rankings and average WED estimates to measure production from these resource types on SCDNR waterfowl areas.

WMA INFRASTRUCTURE UPDATES

During the 2023 growing season and 2023-24 waterfowl season we experience multiple significant weather events that impacted waterfowl areas across the state. The impact of these events to coastal, Midlands, and Upstate properties are detailed below.

COASTAL PROPERTIES

Charleston Harbor recorded 151 king tides (tide of at least 6 feet, 6 inches in height) during 2023. These continued high tides can significantly erode already fragile dikes.

DAMAGE FROM TROPICAL STORM IDALIA TO SCDNR CATEGORY 1 WATERFOWL AREAS ON AUG. 30, 2023

On Aug. 30, 2023, Tropical Storm Idalia impacted coastal South Carolina with torrential rainfall, wind gusts to 75 mph, and storm surge coupled with already high astronomical tides. Charleston Harbor recorded its fifth-highest peak tide in history during the event.

BEAR ISLAND:

- One near breach on Matthews Canal. Dikes along the exterior were overtopped and some erosion occurred. An onsite tracked trackhoe was matted to the site to repair the near breach.

SAMWORTH:

- Dikes along the exterior were overtopped in Pullfare & the Carr Complex. The Little Carr Impoundment was 3-4 ft deep.
- Lower Middleton experienced three breaches in the setback dike that had been constructed to regain water control in a portion of the impoundment following the breach incurred during Hurricane Ian.

SANTEE COASTAL RESERVE – MURPHY ISLAND:

- Multiple dike issues include near breaches and severe erosion on exterior dikes along the Intracoastal Waterway.
- Serious dike erosion and near breaches were incurred on the southern end of the recently renovated Boggy Island portion.
- Breach in an interior setback dike on northern end of Murphy Island.

SANTEE COASTAL RESERVE – CEDAR ISLAND:

- Several near breaches along South Santee River and considerable erosion. As a result, perimeter dikes of the impoundment are very fragile and may be susceptible to additional damage from future events.

DAMAGE TO CAT 1 WATERFOWL AREAS FROM THE NOR'EASTER STORM ON DECEMBER 17, 2023

Between 8 and 14 inches of rain fell along the coast which resulted in severe damage to some of the SCDNR coastal properties. Gusty winds from 35-60 mph, coupled with an

extremely high tide (crest at 9.86 ft) produced the fourth-highest tide on record and the highest non-tropical high tide on record. This weather event resulted in the cancellation of one lottery hunt on Cedar Island at Santee Coastal Reserve. Rain from this and subsequent events resulted in continual flooding of the North and South Santee Rivers during the 2023-2024 waterfowl season and required the cancellation of three lottery hunts at Santee Delta East WMA.

BEAR ISLAND/DONNELLEY:

- Donnelley suffered some impoundment flooding, and a few trees were down, but no significant damage.
- Bear Island had significant overtopping of all exterior dikes with mostly minor/average scouring and erosion along a significant portion of the dike system.
    - All impoundments were deeply flooded due to tidal water overtopping the dikes.

RAMSEY GROVE:

- Major overtopping of the dike along the Black River resulted in severe erosion on portions of the dike system. This damage will need to be addressed after the waterfowl season.
- The impoundment was deeply flooded due to overtopping.

SAMWORTH:

- Most all impoundments suffered from overtopping along with minor to severe dike erosion/scouring. Water levels in all impoundments were extremely deep.
- Cane Patch- A trunk door was destroyed.
- Lower Middleton- Two small breaches occurred in the temporary setback dike.
- Upper Middleton- A large breach occurred in the perimeter dike along the Waccamaw River.

SANTEE DELTA:

- Santee Delta East experienced minor dike scouring.
    - Impoundments were deeply flooded with some cross dikes being under water.
- Santee Delta West suffered limited perimeter dike erosion; however, erosion of cross dikes was severe.
    - Impoundments were deeply flooded for an extended period of time.

SANTEE COASTAL RESERVE – CAPE:

- Severe dike erosion in two locations. Water crossed interior dikes in some locations.
- One trunk nearly breached.

SANTEE COASTAL RESERVE – CEDAR ISLAND:

- 10 locations that stretch for several hundreds of yards were reported to have severe erosion.
- Two dike breaches (one exterior on ocean side, one interior on South Santee River side).
- Two near breaches (95% of dike gone) on North Santee River side.
- Interior dikes completely eroded away.

SANTEE COASTAL RESERVE – MURPHY ISLAND:

- 18 locations that stretch for several hundreds of yards with severe erosion.
- One breach on interior setback dike on South Santee River.
- One minor breach at a trunk on South Santee River.
- Two near breaches on Intracoastal Waterway.
- South end of the Boggy Unit was severely eroded with numerous near breaches from Tropical Storm Idalia. This weather event breached and eroded the dike for a large portion of the south end.

MIDLANDS AND UPSTATE PROPERTIES

BROAD RIVER WMA

- Staff battle continual flooding of impoundments from Terrible Creek following rain events during the growing season. Staff began the process to obtain approval from Dominion Energy to create a borrow pit adjacent to the site to build up dikes and prevent or reduce impact from future flood events. Staff have also sought approval to remove a water control structure and install a low-water crossing into the DU pond to prevent water from backing up and flowing into the GTR and Old Impoundment.
- Due to excessive drought in fall 2023 and low river levels, staff were unable to flood impoundments from the Broad River until early December.
- Jan. 10, 2024: A significant and rapid rainfall event in the Upstate resulted in a significant downstream flood event. Impoundment dikes were overtopped and experienced erosion and sinkholes in multiple dikes. Impoundments were flooded to depths more than 4 feet across the property and resulted in the cancellation of two waterfowl lottery hunts.

BEAVERDAM CREEK WMA

- Spring 2023: A renovation project was completed where all interior ditches were cleaned out, a new pump was installed, and improvements were made to two emergency spillways. This work was completed as part of a small North American Coastal Wetlands Grant in partnership with Ducks Unlimited.
- Jan. 10, 2024: A significant and rapid rain event produced in excess of 3 inches of rain. Impoundments were flooded to depths of 4 feet or more, dikes were overtopped resulting in significant erosion and damage to the emergency spillway.

CLEMSON WATERFOWL AREA

- Continual efforts were made to maintain the water control structure clear and free of debris from beavers.
- Spring 2023: Interior ditches were cleaned out to improve drainage of the field bed for planting.
- A new pump was added to improve drainage of the impoundment during the growing season.

WATERFOWL MANAGEMENT AREA PEER REVIEWS

The Waterfowl Management Area Peer Review Program was developed in 2021as a proactive measure to critically assess all aspects of management on SCDNR Category 1 Waterfowl Management Areas. Each evaluation is completed by a panel of nationally recognized wetland management experts from across the country. During the review process, these professionals are tasked with assessing and evaluating habitat management practices, infrastructure needs, and hunt management on Category 1 WMAs.

This Peer Review Program serves to provide direction for prioritizing improvement projects on individual WMAs, while also providing leadership direction as they prioritize infrastructure projects across all waterfowl areas. By welcoming local and national waterfowl management experts to critically evaluate the successes and challenges of management on Category 1 Waterfowl Areas, this Peer Review Program serves to align biologists, staff, and leadership with goals to provide the highest-quality habitat for wintering waterfowl, and hunting opportunities for the public. As a bonus, the program also provides opportunities for field biologists and staff to broaden their professional networks to include some of the most successful waterfowl managers across the nation.

The Peer Review Program is implemented in two phases with the oversight of a third-party program facilitator. Phase one involves 1-2 on the ground field visits with the review panel, area biologists, and staff. Phase two includes a synthesis of panelist's observations and findings compiled by the facilitator, and production of a final report for the property under evaluation.

Over a series of years, evaluations will be completed on all Category 1 Waterfowl Management Properties. To date final reports have been produced for Samworth WMA (2022), Bear Island WMA (2023), Wateree HP WMA & Love Farm WMA (2024), and Santee Coastal Reserve WMA (2024). All reports can be found at: https://www.dnr.sc.gov/hunting/migratory.html.

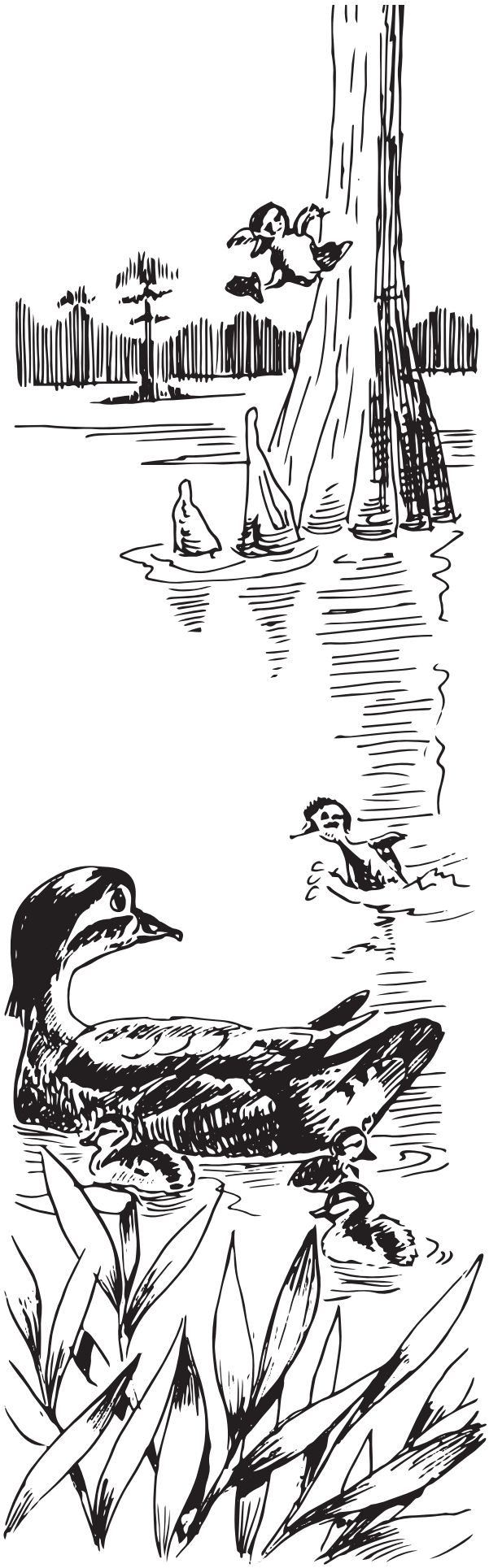
WODU BOX PROGRAM

The wood duck is one of the most important species to South Carolina waterfowl enthusiasts and is the only duck we can effectively manage production habitat for throughout all geographic regions of the state. The Wood Duck Box Program was implemented in 1982 in effort to increase wood duck production by providing artificial nest boxes to supplement natural cavities of forested wetlands. Since 1982, with funding support from the State Migratory Waterfowl Permit, the program has distributed a total 45,784 nest boxes for private landowners to install and maintain in wetlands across the state. This program is arguably one of the agency's most popular outreach programs to date.

In the fall of each year using the Go Outdoors SC app, private landowners can apply for up to three wood duck nest boxes. Individuals are selected through a lottery and receive both box(es) and predator guard(s) that are distributed from select SCDNR offices in December and January of each year.

Boxes from the 2023 distribution were the first to have metal tags with QR codes (Figure 10). Landowners can scan the QR code with a smartphone and be directed to a webpage that allows them to report if the nest box was used, and if so, how many ducklings were estimated to have been produced from that box. The codes provide an easy way for private landowners to submit nesting activity reports from boxes they maintain on their property. This data will allow the agency to produce annual estimates of box use and duckling production from monitored nest boxes across the state.

In early winter 2024, we anticipate distribution of 1,200 new nest boxes and predator guards. Additional metal tags with QR codes will also be available to landowners desiring to add those to existing boxes.



EDUCATION AND OUTREACH

EDUCATION

On Aug. 15-16, 2023, the Waterfowl Program hosted a workshop in Georgetown County on "Management of Wetlands for Waterfowl and Wetland Plant Identification". The workshop was instructed by Kevin Nelms, USDA NRCS wildlife biologist from Mississippi. Nelms has an extensive resume, having applied and tested his waterfowl management knowledge on thousands of properties in the Mississippi Delta Region. Nelms was selected to lead this workshop for his ability to instruct the "how" and "why" of waterfowl management, teaching workshop attendees not only how to implement management actions, but why they should consider certain management regimes to ensure we meet the needs of waterfowl throughout the annual cycle.

The workshop was attended by 48 SCDNR biologists and technicians that work on Category 1 and 2 Waterfowl Areas. Over the course of the workshop, staff received instruction on the following topics: Non-breeding & Wintering Waterfowl Ecology and Energetics—A basis for management; Moist-Soil Management—Introduction and implementation; Wetland Succession and Waterfowl Use; Wetland Invertebrates—Importance and considerations for management; and Agricultural Crops for Waterfowl. Field tours were hosted on privately owned, Rochelle Plantation and SCDNR's Santee Delta WMA. Topics of field tour discussions included: plant identification; drawdown zonation; effects of management disturbance and timing; wetland successional types; and problem vegetation and control measures. At the conclusion of the workshop, staff were better equipped to assess management options to maximize waterfowl potential on their WMAs.

Leadership has received numerous positive reports from field staff about the workshop. Biologist Kneece has made numerous field visits to WMAs to discuss the application of many management scenarios staff learned and are applying from the workshop. The Waterfowl Program anticipates holding similar workshops for staff to help remain current with adaptive management practices and waterfowl ecology topics.

OUTREACH

On Aug. 22, 2023, the Agency hosted a Landowner Field Day at Samworth WMA. The event was attended by 25 neighboring private landowners and SCDNR Board Vice-Chairman Mike Hutchins. The Field Day included presentations on sea level rise with Dr. Tom O'Halloran (Clemson University), wood duck box management recommendations with Beau Bauer (Nemours Wildlife Foundation), a brief talk from SePRO Aquatic Chemicals, a drone spraying demonstration by Land Services, and a management and infrastructure update on Samworth WMA from SCDNR leadership.

Attendees were also given the opportunity to tour Samworth impoundments and see infrastructure improvements and habitat management techniques that are being implemented on the property. The Field Day cultivated a great atmosphere and opportunity for SCDNR staff and local landowners to discuss experiences in managing habitats that are facing similar management challenges.

TABLES

TABLE 1. *SCDNR lottery waterfowl hunt participation by WMA, 2023-24.*

WMA	# of Hunts Scheduled	# Hunts Cancelled	# Hunters Selected by Lottery	Hunter Opportunity Lost Due to Cancelled Hunts	# Hunters Possible after Cancellations	# Hunters that Participated	% Participation
Bear Island	18		340		340	309	91%
Beaverdam	6	1	59	10	49	44	90%
Broad River	7	2	81	22	59	45	76%
Samworth	3		16		16	14	88%
Sandy Beach	8		32		32	30	94%
SCR- Cedar	9	1	107	12	95	88	93%
SCR- Murphy	9		162		162	151	93%
SCR- Cape	9		144		144	134	93%
Santee Delta East	7	3	41	17	24	21	88%
Wateree	10		40		40	34	85%
ALL SITES	**86**	**7**	**1022**	**61**	**961**	**870**	**91%**

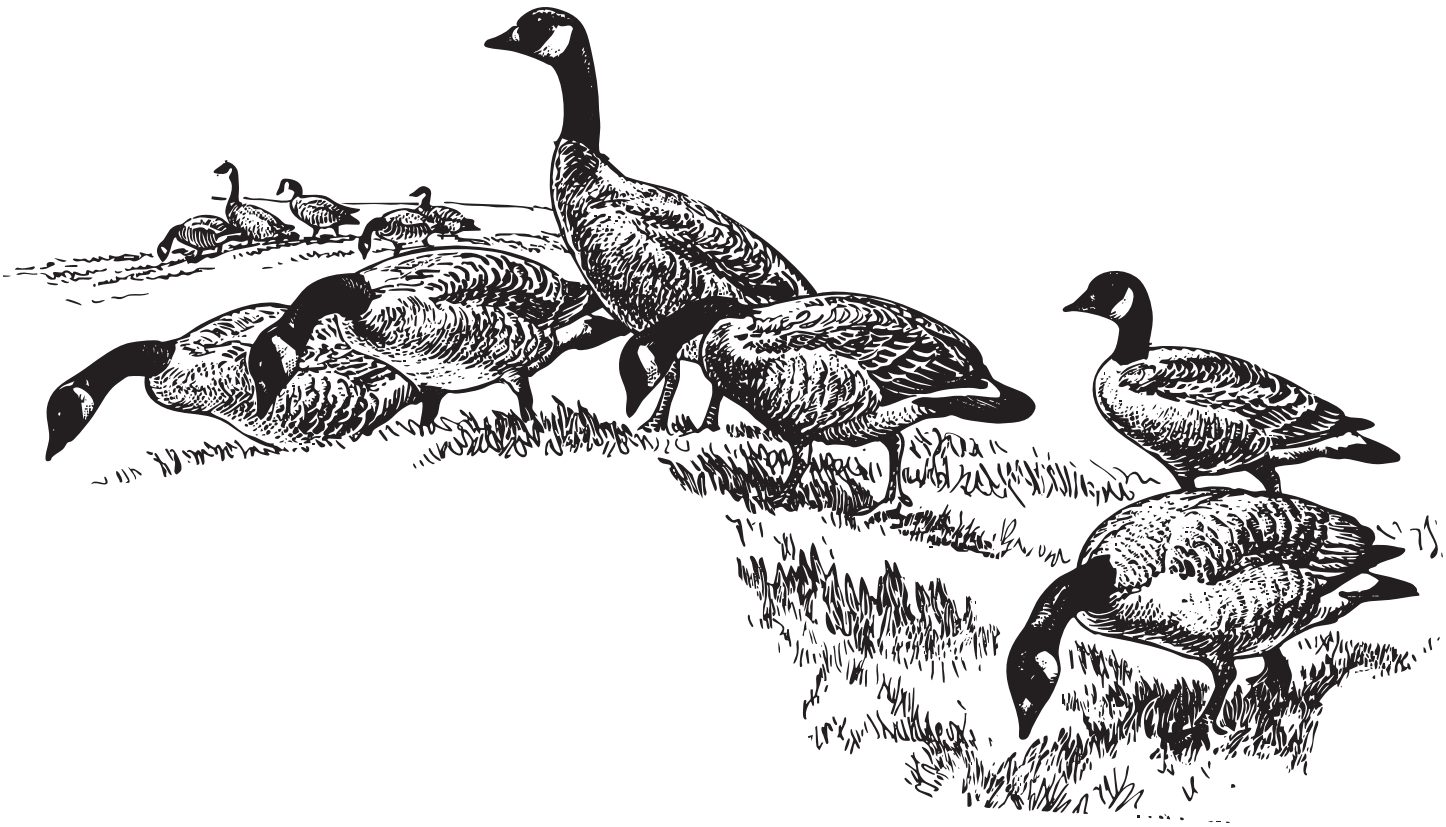


TABLE 2. *Waterfowl harvest statistics on SCDNR Lottery Hunt WMAs, 2023-24.*

2023-2024 SPECIES	BEAR ISLAND	BEAVERDAM CREEK WMA	BROAD RIVER WMA	WATEREE RIVER HP	SAMWORTH WMA	SANDY BEACH WMA	SANTEE-DELTA EAST	SCR THE CAPE	SCR CEDAR IS	SCR MURPHY IS	SCR TOTAL	CATEGORY 1 TOTAL
Mallard	9	3	10	1		6	4	4	2	1	7	40
Dom/Rel Mallard	3	10		5								18
Black Duck	2		2			1	1	1	4	4	9	15
Mallard x Black	1											1
Mottled Duck	80						2	31	11	23	65	147
Gadwall	46		4		1	8		99	41	102	242	301
American Wigeon	4		3			1		14	1	44	59	67
Green-winged Teal	187	1	51	7	2	29	13	101	114	202	417	707
Blue-winged Teal	152		1			7	11	107	85	62	254	425
Northern Shoveler	84					1	1	38	45	94	177	263
Northern Pintail	24							70	28	90	188	212
Wood Duck	47	12	6	33	8	13	1					120
Redhead												
Canvasback												
Scaup	9		1			1		16	1	3	20	31
Ring-necked Duck	3		7			5	3	5	1	17	23	41
Golden-eye												
Bufflehead	18							5	2	8	15	33
Ruddy Duck								8	5	6	19	19
Tree ducks												
Sea ducks								1			1	1
Canada Goose												
Snow Goose	1									1	1	2
Coot	10									4	4	14
Mergansers	43			5	2			12	2	2	16	66
TOTAL HARVEST	**723**	**26**	**85**	**51**	**13**	**72**	**36**	**512**	**342**	**663**	**1517**	**2523**
# HUNTERS	**309**	**44**	**45**	**34**	**14**	**30**	**21**	**134**	**88**	**151**	**373**	**870**
DUCKS/HUNTER	**2.3**	**0.6**	**1.9**	**1.5**	**0.9**	**2.4**	**1.7**	**3.8**	**3.9**	**4.4**	**4.1**	**2.9**
SHOTS FIRED	**3940**	**328**	**505**	**409**	**106**	**30**	**170**	**2348**	**1608**	**2921**	**6877**	**12365**

TABLE 3. *Waterfowl harvest statistics for SCDNR Youth Lottery Hunt WMAs, 2023-24.*

2023-2024 YOUTH SPECIES	BEAR ISLAND	BEAVERDAM CREEK WMA	BROAD RIVER WMA	BONNEAU FERRY WMA	CLEMSON WMA	DONNELLY WMA	SCR THE CAPE	SCR MURPHY IS	SANDY BEACH WMA	WATEREE RIVER HP	GRAND TOTAL
Mallard				2		2					4
Dom/Rel Mallard											
Black Duck		1					6				7
Mallard x Black											
Mottled Duck	2					7	2	1			12
Gadwall	4			3		8	1				16
American Wigeon				1							1
Green-winged Teal	19			31	1	33	14	12			110
Blue-winged Teal	1			1			12	3			17
Northern Shoveler	2					1	1	4			8
Northern Pintail							5	2			7
Wood Duck	3			31	4	10				2	50
Redhead											
Canvasback											
Scaup											
Ring-necked Duck			2	65	1	3					71
Golden-eye	1										1
Bufflehead	2							1			3
Ruddy Duck											
Tree ducks											
Sea ducks											
Canada Goose											
Snow Goose											
Coot				3							3
Mergansers		1		2	1	17	2			3	26
ONLY FEB. YOUTH DAY HUNT	**x**	**x**	**x**				**x**	**x**	**x**		**x**
TOTAL HARVEST	**34**	**2**	**2**	**139**	**7**	**73**	**50**	**24**	**0**	**5**	**336**
# HUNTERS	**11**	**4**	**3**	**51**	**11**	**29**	**10**	**8**	**2**	**3**	**132**
DUCKS/HUNTER	**3.1**	**0.5**	**0.7**	**2.7**	**0.6**	**2.5**	**5**	**3**	**0**	**1.7**	**2.5**
SHOTS FIRED	**192**	**26**	**34**	**853**	**73**	**472**	**187**	**156**	**14**	**46**	**2053**

TABLE 4. *Abundance of waterfowl by WMA and guild estimated during aerials surveys, January 16-17, 2024.*

WMA	DABBLING DUCKS	DIVING DUCKS	GEESE	SWANS	CRANES	TOTAL WTRFL
Yawkey	14,035	3,146	0	0	0	17,181
Samworth	0	0	0	0	0	0
Santee Coastal	33,970	3,603	0	0	0	37,573
Santee Delta	7	0	0	0	0	7
Sandy Beach	40	6	0	0	0	46
Bear Island	3,380	1,026	0	210	0	4,406
TOTAL	**51,432**	**7,781**	**0**	**210**	**0**	**59,213**

TABLE 5. *A summary of FY23 Waterfowl Permit (Duck Stamp) requests and expenditures.*

DESCRIPTION OF REQUEST	BUDGET	EXPENDED	% EXPENDED
Statewide Wood Duck Box Project	$110,000	$63,536	58%
Wood Duck Nest Box Recruitment Project, year 4 (per year for 3-5 years)	$30,000	$26,306	88%
Development of Waterfowl Abundance and Habitat Quality Surveys	$30,000	$0	0%
Migration Ecology and Demographics of E. Mallards (year 2 of 4)	$6,000	$6,304	105%
Beaverdam WMA Renovation, NAWCA Match	$68,563	$0	0%
Atlantic Flyway Council Banding Assessment and Dues	$11,500	$11,435	99%
Habitat Management: Plantings, Maintenance, Structures, and Equipment	$144,700	$161,820	112%
TOTAL REQUEST FOR FY23	**$400,763.00**	**$269,401**	**67%**

TABLE 6. *A summary of FY24 Waterfowl Permit (Duck Stamp) requests and expenditures.*

DESCRIPTION OF REQUEST	BUDGET	EXPENDED	% EXPENDED
Statewide Wood Duck Box Project	$110,000	$89,908	82%
Moist Soil Management Workshop	$7,000	$4,275	61%
Wood Duck Nest Box Recruitment Project, year 5	$15,000	$31,281	209%
Midwinter Aerial Surveys and Habitat Assessment	$30,000	$0	0%
Migration Ecology and Demographics of E. Mallards (year 3 of 4)	$6,000	$0	0%
Control of Undesirable Vegetation	$40,000	$15,000	38%
Atlantic Flyway Council Banding Assessment and Dues	$11,500	$11,435	99%
Habitat Management: Plantings, Maintenance, and Equipment	$195,500	$105,232	54%
AFWA Fall Flights Program (Contribution to DU Canada)	$61,251.00	$61,251.00	100%
SUMMARY FY24	**$415,000.00**	**$318,382**	**77%**

TABLE 7. *A summary of Waterfowl Energy Day (WED) production from moist soil, corn, and rice by site, Fall 2023.*

	Waterfowl Energy Days by Site								
Site	**Moist Soil**	**Corn**	**Rice**	**Moist Soil Ac.**	**Corn Ac.**	**Rice Ac.**	**Total Ac. Assessed**	**WED/Ac**	**Total WED**
Bear Island	656,799	88,405		120	10		130	5,732	745,204
Bonneau Ferry	29,393	19,845		15	5		20	2,462	49,238
Broad River	27,133	221,856	23,459	18	7	6	31	8,789	272,448
Donnelley	696,791			95			95	7,335	696,791
Love Farm		81,583			7		7	11,655	81,583
Samworth	147,135			40			40	3,678	147,135
Santee Delta East- Unit 1	40,424			108			108	374	40,242
Wateree River HP		104,810			12		12	8,734	104,810
SURVEYED CAT 1 TOTAL	**1,597,675**	**516,499**	**23,459**	**396**	**41**	**6**	**443**	**4,825**	**2,137,633**

FIGURES

FIGURE 1. *Known harvest locations of 22 web-tagged wood ducks tagged on Lake Moultrie, SC, 2019-2023.*

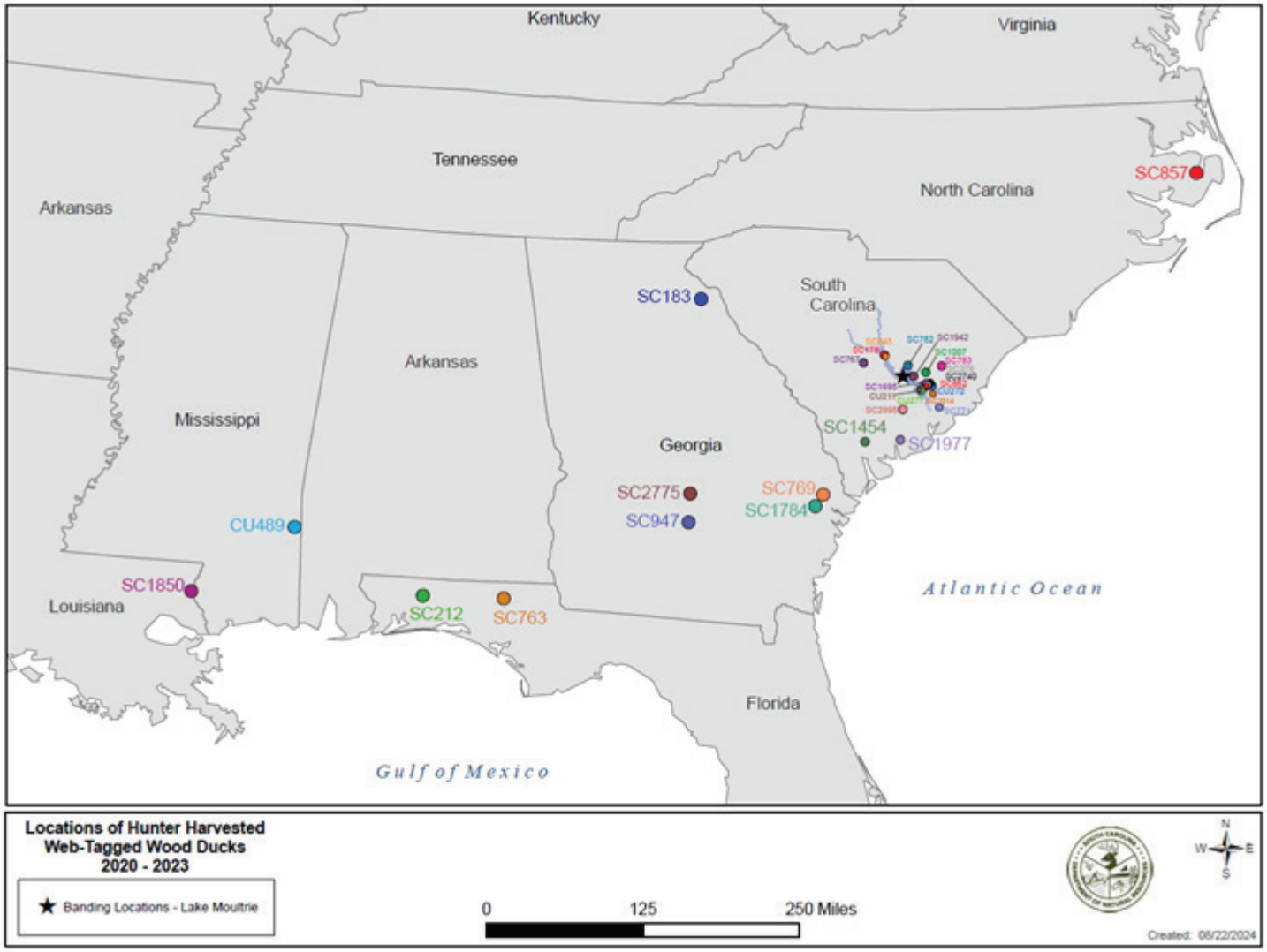


FIGURE 2. *Movements of mallards outfitted with transmitters in SC in February 2022. Tracks represent movements from February 2022-December 2023.*

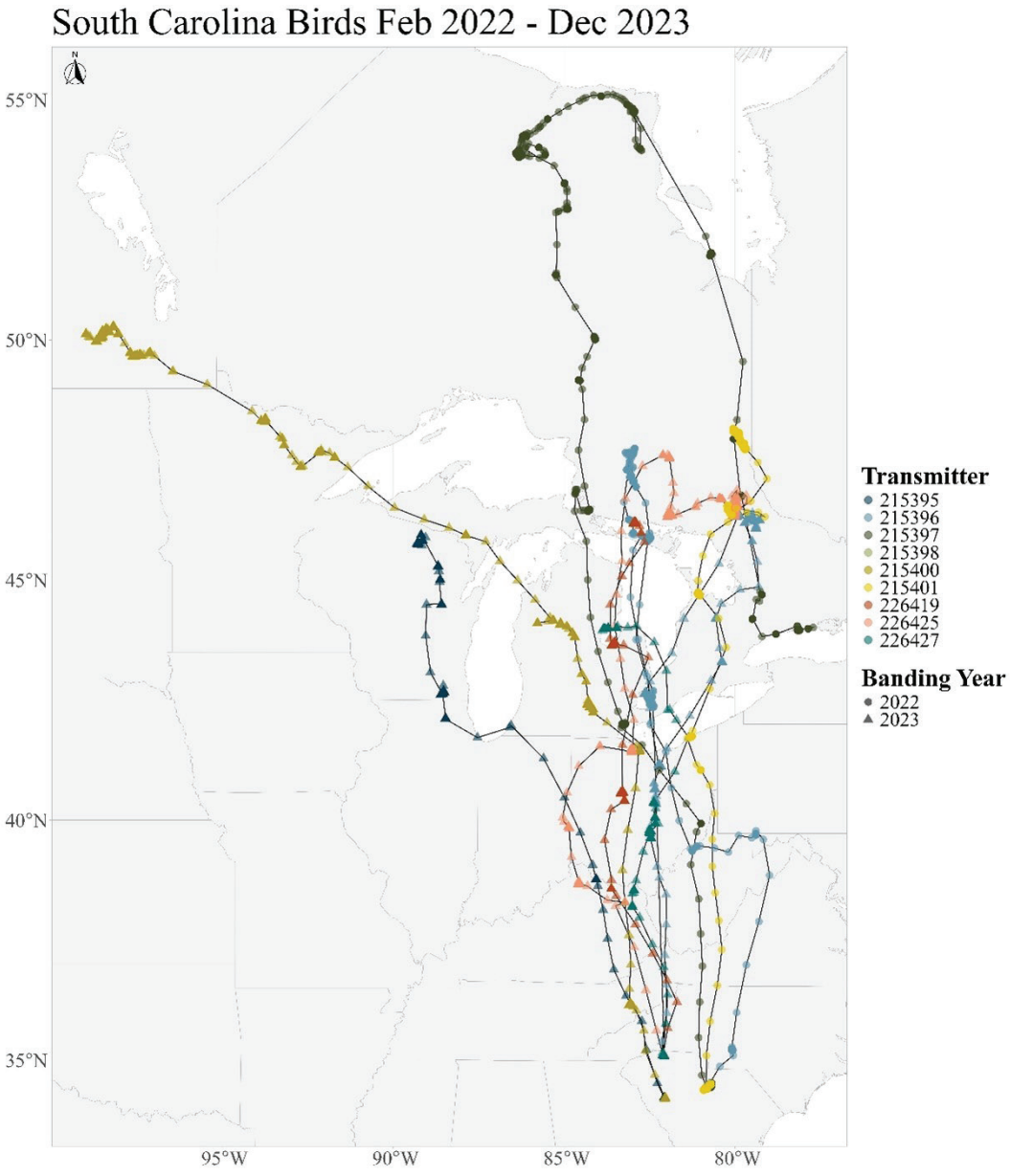


FIGURE 3. *Long term harvest average of ducks/hunter, under a six-bird bag limit on SCDNR Lottery Hunt Properties, 1998-2024.*

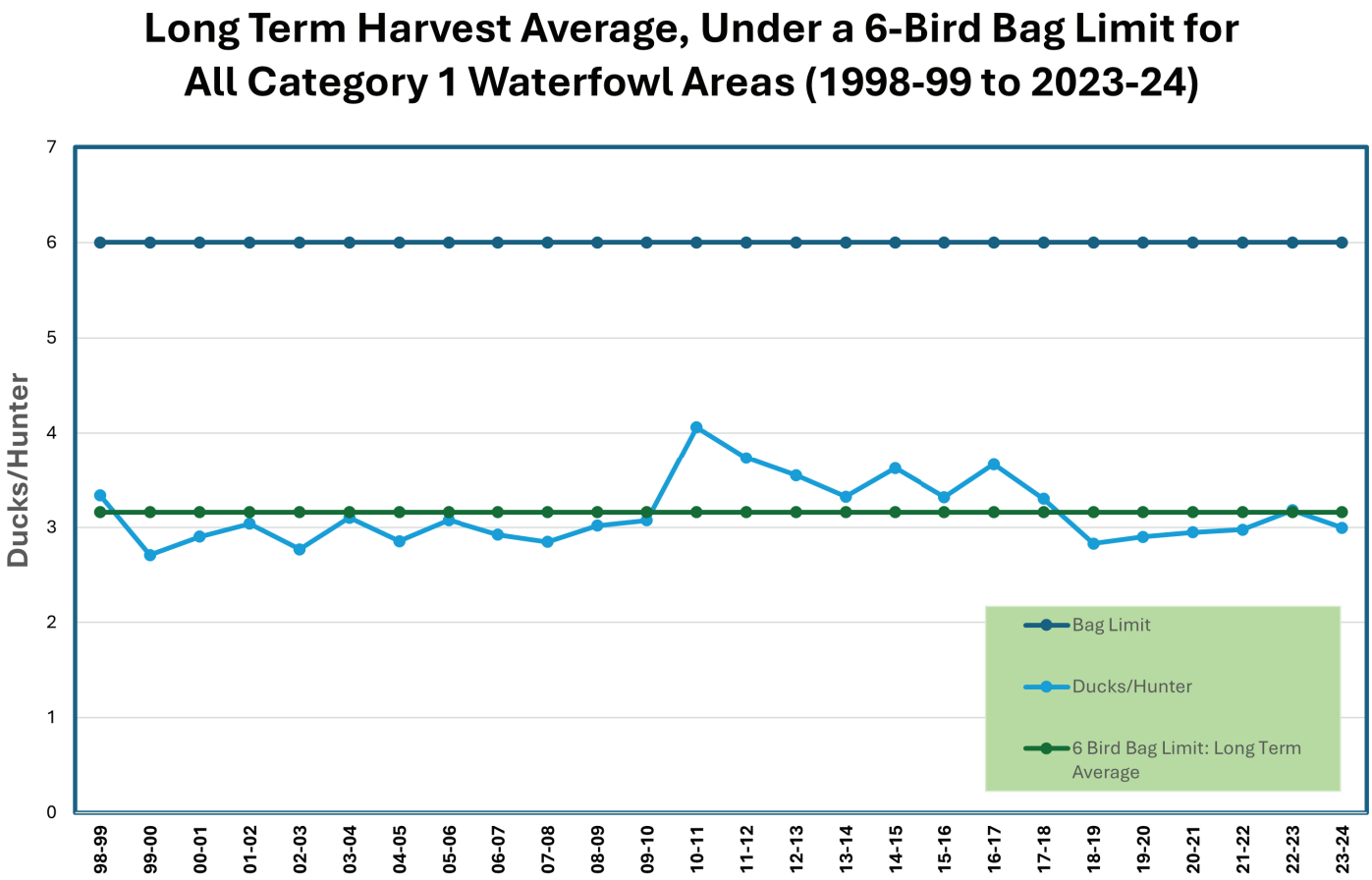
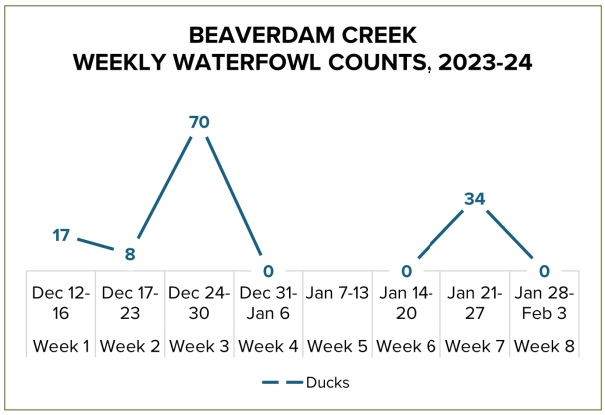
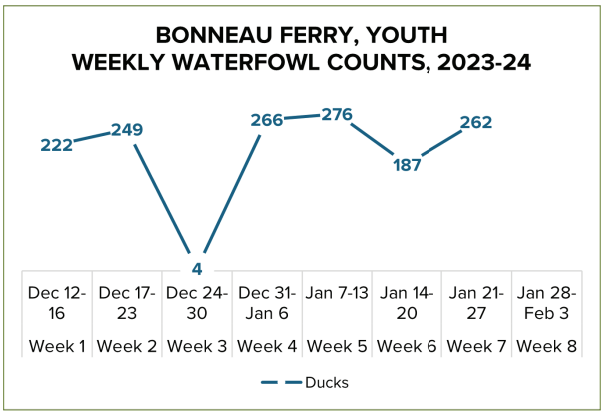
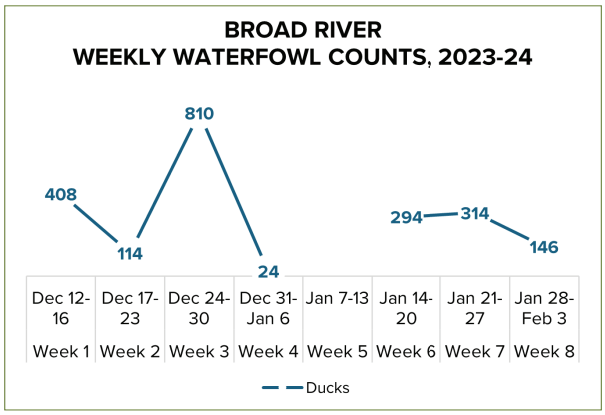
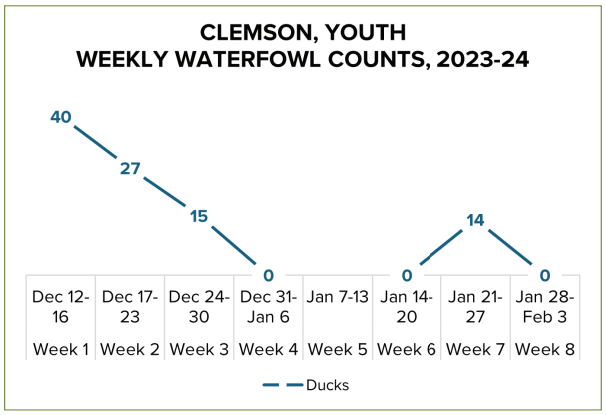


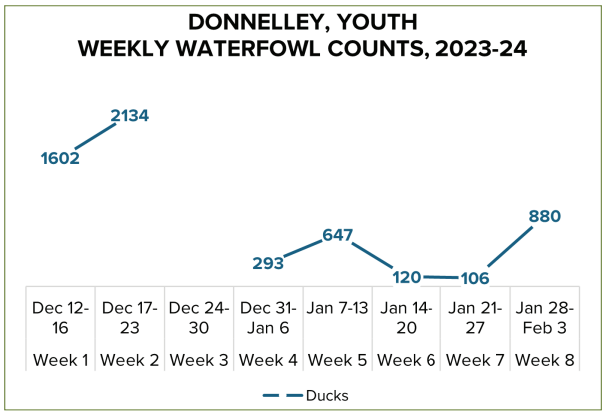
FIGURE 4. *Weekly abundance estimates for waterfowl abundance obtained from ground counts on 10 SCDNR Waterfowl Areas, 2023-24. Count data is considered minimum abundances for all waterfowl areas, and these were not applied as complete flush counts to reduce bird disturbance on all sites.*

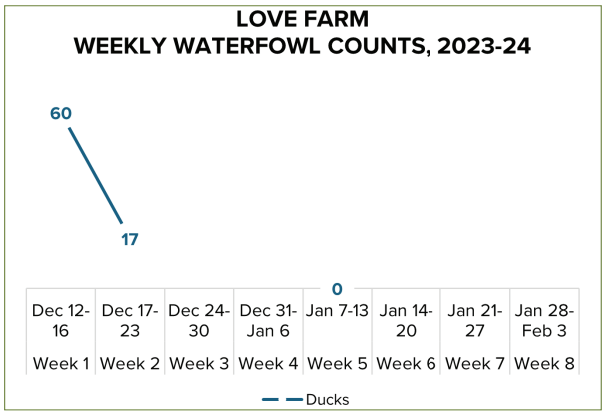


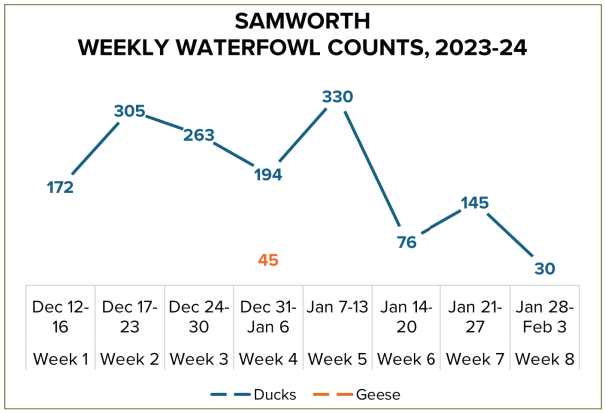


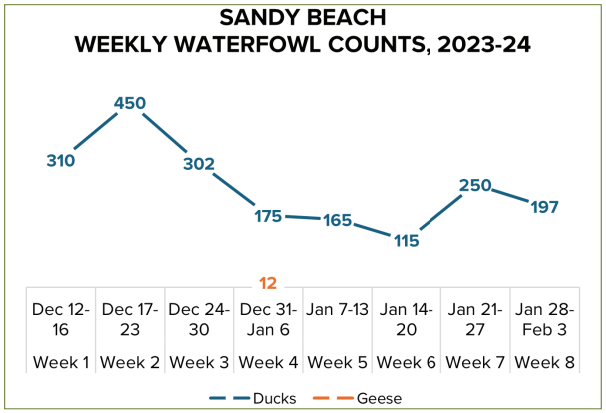

BROAD RIVER
WEEKLY WATERFOWL COUNTS, 2023-24
408
114
810
24
294
314
146
Dec 12-16
Dec 17-23
Dec 24-30
Dec 31-Jan 6
Jan 7-13
Jan 14-20
Jan 21-27
Jan 28-Feb 3
Week 1
Week 2
Week 3
Week 4
Week 5
Week 6
Week 7
Week 8
Ducks

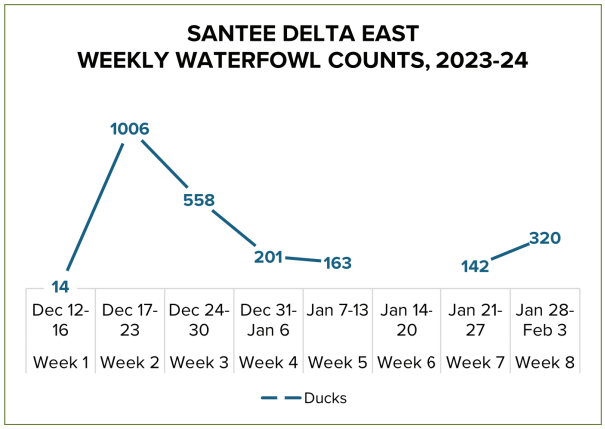

CLEMSON, YOUTH
WEEKLY WATERFOWL COUNTS, 2023-24
40
27
15
0
0
14
0
Dec 12-16
Dec 17-23
Dec 24-30
Dec 31-Jan 6
Jan 7-13
Jan 14-20
Jan 21-27
Jan 28-Feb 3
Week 1
Week 2
Week 3
Week 4
Week 5
Week 6
Week 7
Week 8
Ducks

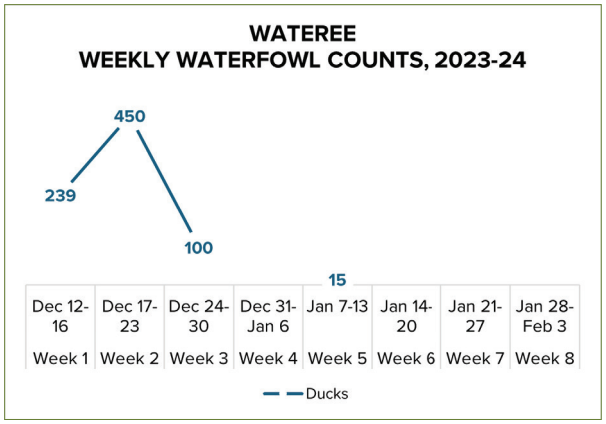

DONNELLEY, YOUTH
WEEKLY WATERFOWL COUNTS, 2023-24
1602
2134
293
647
120
106
880
Dec 12-16
Dec 17-23
Dec 24-30
Dec 31-Jan 6
Jan 7-13
Jan 14-20
Jan 21-27
Jan 28-Feb 3
Week 1
Week 2
Week 3
Week 4
Week 5
Week 6
Week 7
Week 8
Ducks


LOVE FARM
WEEKLY WATERFOWL COUNTS, 2023-24
60
17
0
Dec 12-16
Dec 17-23
Dec 24-30
Dec 31-Jan 6
Jan 7-13
Jan 14-20
Jan 21-27
Jan 28-Feb 3
Week 1
Week 2
Week 3
Week 4
Week 5
Week 6
Week 7
Week 8
Ducks


SAMWORTH
WEEKLY WATERFOWL COUNTS, 2023-24
172
305
263
194
45
330
76
145
30
Dec 12-16
Dec 17-23
Dec 24-30
Dec 31-Jan 6
Jan 7-13
Jan 14-20
Jan 21-27
Jan 28-Feb 3
Week 1
Week 2
Week 3
Week 4
Week 5
Week 6
Week 7
Week 8
Ducks
Geese


SANDY BEACH
WEEKLY WATERFOWL COUNTS, 2023-24
310
450
302
175
165
115
12
250
197
Dec 12-16
Dec 17-23
Dec 24-30
Dec 31-Jan 6
Jan 7-13
Jan 14-20
Jan 21-27
Jan 28-Feb 3
Week 1
Week 2
Week 3
Week 4
Week 5
Week 6
Week 7
Week 8
Ducks
Geese


SANTEE DELTA EAST
WEEKLY WATERFOWL COUNTS, 2023-24
14
1006
558
201
163
142
320
Dec 12-16
Dec 17-23
Dec 24-30
Dec 31-Jan 6
Jan 7-13
Jan 14-20
Jan 21-27
Jan 28-Feb 3
Week 1
Week 2
Week 3
Week 4
Week 5
Week 6
Week 7
Week 8
Ducks


WATEREE
WEEKLY WATERFOWL COUNTS, 2023-24
239
450
100
15
Dec 12-16
Dec 17-23
Dec 24-30
Dec 31-Jan 6
Jan 7-13
Jan 14-20
Jan 21-27
Jan 28-Feb 3
Week 1
Week 2
Week 3
Week 4
Week 5
Week 6
Week 7
Week 8
Ducks

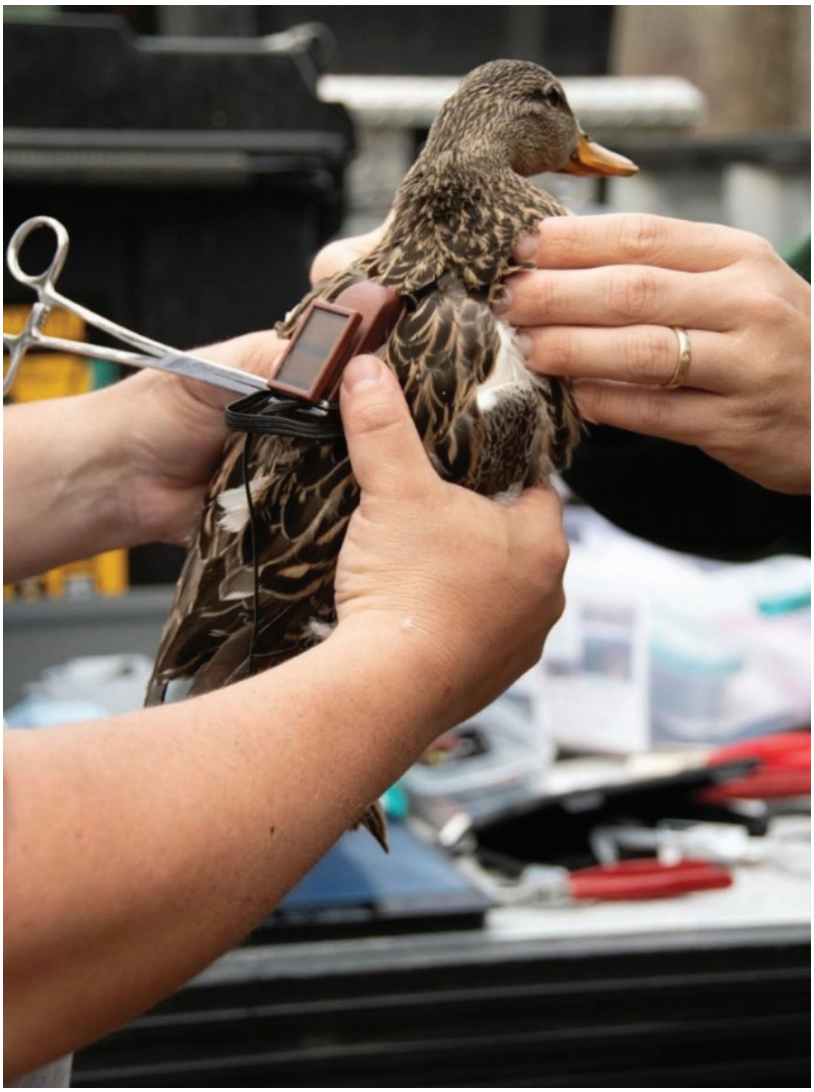


FIGURE 5. *SCDNR staff outfit a mallard hen with a GPS transmitter as part of an Atlantic Flyway research project on migration and habitat use, February 2023.*

FIGURE 6. *Successful plantings of millet and corn for waterfowl lottery hunts at Broad River WMA, November 2022.*

FIGURE 7. *A storage container installed at Santee Delta WMA, November 2023.*

FIGURE 8. *A drive-on floated dock for boat storage on Cedar Island, Santee Coastal Reserve, February 2024.*

FIGURE 9. *A wood duck box funded through the Wood Duck Box Program on Sandy Beach WMA, May 24. New metal plates have a QR code in the bottom right corner that can be scanned with a smart phone to enable those maintaining boxes to easily submit survey information on box use and duckling production.*

FIGURE 10. *Boxes from the 2023 distribution were the first to have metal tags with QR codes. Landowners can scan the QR code with a smartphone and be directed to a webpage that allows them to report information on use and production from nest boxes. This data will allow the agency to produce annual estimates of box use and duckling production from monitored nest boxes across the state.*

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